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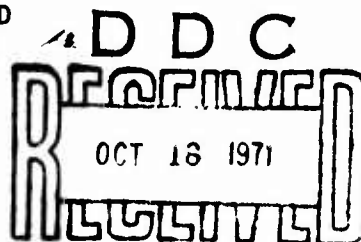
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Materiel Test Procedure 9-2-240
General Equipment Test Activity

U. S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

TRACTORS, WHEELED, AGRICULTURAL



1. OBJECTIVE

This document provides test methodology and testing techniques to determine the technical performance and safety characteristics of wheeled agricultural tractors and associated tools and equipment as described in Materiel Need (MN) and to determine the items suitability for service tests.

2. BACKGROUND

Requirements exist for diesel- or gasoline-powered agricultural type tractors useful for a wide range of drawbar and utility tasks common to Army tactical, engineer, aviation, and supply support units.

Currently, tractors, of this type are widely used in the Army for a variety of missions including mowing, landscaping, outdoor storage area warehousing, earthmoving, road building support and maintenance, and for general construction site utility tasks.

A list of agricultural-type tractor types adopted as standards is provided below to illustrate the scope of the present-day requirement and to suggest the form which future requirements are likely to take.

a. STANDARD (Non-utility): Of four-wheel design with both front and rear tread fixed or adjustable.

b. TRICYCLE ROW-CROP: Tricycle-type tractors have a single front wheel of dual front wheels either adjustable or fixed center. Rear treads are adjustable to accommodate various row widths.

c. WIDE ADJUSTABLE FRONT AND REAR AXLE ROW-CROP: As implied, this tractor type will have both front- and rear-axle adjustments to provide a variety of tread widths. The maximum/minimum adjustment range is usually within the commercial limits corresponding to common row widths.

d. HIGH CLEARANCE ROW-CROP: This tractor type corresponds to the commercial-type vehicle required for high clearance crops such as cane or rice.

Since the Army utilized agricultural-type tractor requirement is essentially one of broad utility, these vehicles are expected to provide for a substantial number of power driven attachments and accessories. In view of this requirement, special attention must be given to tractor safety aspects, including guarded, enclosed, or insulated rotating or reciprocating parts so located as to be, or become, a hazard to the operating or attending personnel.

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Tractors Farm Tractors Agricultural Tractors Wheeled Tractors						

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3. REQUIRED EQUIPMENT

3.1 MAINTENANCE AND INSPECTION FACILITIES

3.2 INSTRUMENTATION AND REQUIRED MATERIALS

- a. POL materials
- b. Stop watch
- c. Inclinator
- d. Pressure gauges
- e. Measuring tapes
- f. Pressure-type indicating device/gauge suitable for attachment to test item clutch pedal
- g. Meteorological instruments
- h. Adapter pulley with diameter equal to test item hand steering wheel diameter.
- i. Tension dynamometer
- j. Platform scale
- k. Steel cable; chain; hooks (for lifting attachment test and drawbar pull test).
- l. Photoelectric switches and timing device (electronic).
- m. Materials for obstacle block construction
- n. Trailing load(s) for test item (equal in gross weight to ten times rated drawbar pull value).

3.3 TESTING FACILITIES

- a. Laboratory and/or bench testing facilities, as required.
- b. Test course, see Appendix A.
- c. Mobile refrigeration test shelter, or equivalent.
- d. Mobile high temperature test shelter, or equivalent
- e. Rain test course.

REFERENCES

- A. Army Regulation 70-10 Research and Development: Test and Evaluation During Research and Development of Material.
- B. Army Regulation 70-38 Research and Development: Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions.
- C. USAMC Pamphlet 706-134 Engineering Design Handbook: Maintainability Guide for Design.
- D. USATECOM Regulation 70-23 Research and Development: Equipment Performance Reports (EPRs).
- E. USATECOM Regulation 385-6 Safety: Verification of Safety of Materiel During Testing.
- F. USATECOM Regulation 700-1 Quality Assurance: Value Engineering.
- G. USATECOM Regulation 750-15 Maintenance of Supplies and Equipment: Maintenance Evaluation During Testing.

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- H. USA HEL Standard S-1-63B Maximum Noise Level for Army Material Command Equipment.
- I. USAGETA Document Human Factors Evaluation Data for General Equipment (HEDGE).
- J. MIL-STD-129 Marking for Shipment and Storage.
- K. MIL-STD-130 Identification Marking of US Military Property.
- L. MIL-STD-209 Slings Eyes and Attachments for Lifting and Tying Down Military Equipment.
- M. MIL-STD-259 Test and Inspection of Tractor, Wheeled, Warehouse.
- N. MIL-STD-461 Electromagnetic Interference, Requirements for Equipment.
- O. MIL-STD-462 Electromagnetic Interference, Characteristics, Measurement of.
- P. MIL-STD-463 Definitions and System of Units, Electromagnetic Interference Technology.
- Q. MIL-STD-810B Environmental Test Methods
- R. MIL-STD-882 System Safety Program for Systems and Associated Subsystems and Equipment: Requirements for.
- S. MIL-STD-1186 Cushioning, Anchoring, Bracing, Blocking, and Waterproofing: with Appropriate Test Methods.
- T. MIL-STD-1400 Engines, Gasoline or Diesel, Methods of Test
- U. MIL-STD-1472 Human Engineering Design Criteria for Military Systems, Equipment and Facilities.
- V. MIL-E-11275 Engines, Gasoline, Industrial Type, General Specifications for.
- W. MIL-E-11276 Engines, Diesel: Industrial, Medium- and High-Speed, General Specification for.
- X. MIL-T-3351 Tractor, Full-tracked, Low-Speed Tractor, Wheeled, Industrial: and their Attachments, Packaging of.
- Y. MIL-T-46729 Tire, Pneumatic, for Military Ground Vehicles.
- Z. MIL-S-10379 Suppression, Radio Interference, General Requirements for Vehicles (and Vehicular Sub-assemblies).
- AA. MTP 2-2-500 Vehicle Characteristics.
- AB. MTP 2-2-502 Inspection (Automotive).
- AC. MTP 2-2-503 Maintenance. (Vehicle).
- AD. MTP 2-2-505 Preliminary Operation. (Automotive)
- AE. MTP 2-2-506 Durability Testing of Wheeled Vehicles.
- AF. MTP 2-2-508 Safety Evaluation (Automotive).
- AG. MTP 2-2-520 Logistics Over the Shore (LOTS).
- AH. MTP 2-4-001 Desert Environmental Test of Wheeled and Tracked Vehicles.
- AI. MTP 2-4-002 Arctic Environmental Test of Wheeled and Tracked Vehicles.
- AJ. MTP 2-4-003 Tropic Environmental Test of Wheeled and General Purposes Vehicles.
- AK. MTP 2-2-601 Electrical Systems (Automotive).
- AL. MTP 2-2-602 Acceleration: Maximum and Minimum Speeds.
- AM. MTP 2-2-603 Vehicle Fuel Consumption.

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AN. MTP 2-2-604 Drawbar Pull.
AO. MTP 2-2-605 Towing Resistance.
AP. MTP 2-2-607 Engine & Power Train Cooling Systems (Vehicles)
AQ. MTP 2-2-608 Braking, Wheeled Vehicles.
AR. MTP 2-2-609 Steering.
AS. MTP 2-2-610 Gradeability and Side Slope Performance
Mobility.
AT. MTP 2-2-611 Standard Obstacles.
AU. MTP 2-2-612 Fording.
AV. MTP 2-2-613 Broadband Radio Interference Tests of Vehicles
& Electrical Equipment, Non-Communication.
AW. MTP 2-2-614 Toxic Hazards Test for Vehicles.
AX. MTP 2-2-619 Soft Soil Vehicle Mobility.
AY. MTP 2-2-650 Cold Starting and Warm-up.
AZ. MTP 2-2-700 Laboratory Tests of Reciprocating Internal
Combustion Engines.
BA. MTP 2-2-703 Laboratory Tests of Power Train Components.
BB. MTP 2-2-704 Tires.
BC. MTP 2-2-707 Kits (Vehicle).
BD. MTP 2-2-708 Vehicle Heaters- Personnel
BE. MTP 2-2-800 Center of Gravity.
BF. MTP 2-2-802 Stowage.
BG. MTP 2-2-803 Human Factors Engineering.
BH. MTP 7-2-509 Air Drop Capability of Materiel. (General)
BI. MTP 7-2-510 Air Drop System and Components.
BJ. MTP 10-2-501 Operator Training and Familiarization.
BK. MTP 10-2-503 Surface Transportability (General Supplies
and Equipment).
BL. MTP 10-2-505 Human Factors Evaluation.
BM. MTP 10-2-507 Maintenance Evaluation.
BN. MTP 10-2-508 Safety.
BO. MTP 10-2-511 Quality Assurance.
BP. Society of Automotive Engineer, Inc. Document 1969
SAE Handbook.

5. SCOPE

5.1 SUMMARY

This document describes the preparation for and methods of evaluating the technical characteristics of tractors wheeled, agricultural, as follows:

a. Preparation for Test - A determination of the condition and physical characteristics of the test item upon arrival. Also, to ensure that the test item is complete and functionally operational, and to provide operator training and familiarization procedures.

b. Subsystem - These procedures provide for the testing of

test item components/assemblies/subassemblies which do not require tractor disassembly or component bench testing. The following individual tests are included:

- 1) Clutch Pedal Test.
- 2) Steering Wheel Test.
- 3) Brake Tests.
- 4) Electrical System Tests.
- 5) Cooling System Test.
- 6) Accessory Tests.

c. Overall Tractor Performance - These procedures provide for the testing of the test item as a unit or system. The following tests are performed:

- 1) Drawbar Pull Test.
- 2) Wheel Slippage Test.
- 3) Acceleration-Acceleration Response Test.
- 4) Speed Test.
- 5) Fuel Consumption Test.
- 6) Turning Radius Test.
- 7) Gradeability and Side Slope Performance Test.
- 8) Fording and Immersion Test.
- 9) Mobility Test.
- 10) Towing Tests.
- 11) Endurance and Durability Test.
- 12) Broadband Radio Interference Test.

d. Environmental Effects - An evaluation to determine test item capability to resist physical damage and to function as intended during or following exposure to Intermediate Climatic conditions and, where required, to climatic extremes.

e. Transportability - An evaluation to determine the ability of the test item to withstand the forces which it will experience during normal handling and transportation.

f. Maintenance Evaluation - To determine and verify the maintenance/maintainability characteristics and requirements of the test item; an appraisal of the design and of the maintenance test package, and the calculation of indicators which express the effects of the preceding aspects.

g. Reliability - An evaluation to determine the probability that the test item will perform its intended function for a specified interval under stated conditions.

h. Safety - An evaluation to determine the safety characteristics and possible hazards of the test item.

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i. Human Factors Evaluation - An evaluation to determine the adequacy of the design and performance characteristics of the test item and associated equipment in terms of conformance to accepted human factors engineering design criteria.

j. Value Analysis - An evaluation directed at analyzing the primary functions and features of the test item for the purpose of reducing the cost of the test item without compromising the desired performance and safety characteristics.

k. Quality Assurance - An evaluation of the test item with the objective of appraising the quality of workmanship and the degree of material freedom from defects and flaws.

5.2 LIMITATIONS

None

6. PROCEDURES

6.1 PREPARATION FOR TEST

6.1.1 Initial Inspection

Upon receipt of the test item at the test site, perform applicable procedures of MTP 2-2-502 and the following:

a. Visually inspect the packaged test item. Record the following:

- 1) Evidence of damage incurred during transport or storage.
- 2) Exterior identification markings not in accordance with MIL-STD-129 or other governing documents.

b. Unpack and remove all traces of protective transport/storage materials. When this has been accomplished, visually inspect the test item. Record evidence of the following:

- 1) Interior marking(s) of shipment not in accordance with MIL-STD-129 or other governing documents.
- 2) Evidence of defects in test item materials and construction, treatment and finish, and/or workmanship.

6.1.2 Inventory Check

a. Conduct an inventory against the Basic Issue Item List (BIIL). Record evidence of the following:

- 1) Missing maintenance literature or draft technical manuals.

- 2) Shortages in repair parts, accessories, or tools.
- 3) Missing kits.

b. Submit an Equipment Performance Report (EPR) for each noted shortage or discrepancy.

6.1.3 Inspection and Preliminary Operation

a. Perform periodic inspection(s) and maintenance as required by the draft technical manual and in accordance with applicable inspection procedures of MTP 2-2-502.

b. Establish that the actual test item serial number and engine identification number match those numbers which appear on records accompanying the test item.

c. Read the test item running-time meter; if the total elapsed operating time is less than four hours, or less than an otherwise specified elapsed time, subject the test item to the break-in procedures of MTP 2-2-505.

6.1.4 Laboratory and Bench Tests

Pre-engineering tests are required to evaluate, under laboratory conditions, the performance and endurance of the test item major components and thereby establish the suitability of testing the tractor as a system.

6.1.4.1 Reciprocating Internal Combustion Engine Tests

Subject the test item engine type to the procedures of MTP 2-2-700 and appropriate selection criteria of MIL-E-11275 or MIL-E-11276.

6.1.4.2 Power Train Component Tests

Subject test item power train components (clutch, transmission, transfer case, drive shaft, differential, axles, and brakes) to the procedures of MTP 2-2-703.

6.1.4.3 Tire Tests

Subject test item tire type(s) to the procedures of MTP 2-2-704 and the selection criteria of MIL-T-46729.

6.1.4.4 Exhaust System Tests

Subject test item exhaust system to the toxic fumes test procedures of MTP 2-2-614.

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6.1.4.5 Center of Gravity Determination

Determine the vertical and horizontal center of gravity by utilization of applicable procedures of MTP 2-2-800.

6.1.5 Physical Characteristics

Perform applicable procedures of MTP 2-2-500. Measure, as applicable, and record the following data:

- a. Engine.
 - 1) Type, i.e., gasoline or diesel.
 - 2) Characteristics, i.e., bore, stroke, displacement, compression ratio, r.p.m. at maximum torque, etc.
 - 3) Fly wheel horsepower.
- b. Width, less attachments, accessories, or accessory mount(s).
- c. Test item length, less coupler(s).
- d. Height, less cab.
- e. Turning radius, minimum.
- f. Wheelbase.
- g. Track width, maximum and minimum, if adjustable.
- h. Governed speed.
- i. Drawbar pull.
- j. Center of gravity:
 - 1) Vertical.
 - 2) Horizontal.
- k. Gross vehicle weight.
- l. Counter weight information, e.g., removable, weight, etc.
- m. Safety equipment supplied.
- o. Tires:
 - 1) Front.
 - a) Size, i.e., 6:40-15, etc.
 - b) Number of plies, i.e., 4, 6, 8, etc.

- 2) Rear (record identical data as front tires).

6.1.6 Operator Training and Familiarization

Test personnel shall receive training and familiarization in accordance with applicable procedures of MTP 10-2-501 and the following:

a. Terminology - Familiarize team members with trade terms and unique state-of-the-art terminology not otherwise defined in the supplied instructional matter.

b. Test personnel shall be made aware of all known or potential hazards associated with the test item and testing environment(s). The familiarization shall include, but not be limited to, the following:

- 1) Fire hazards, fighting, and prevention.
- 2) Noise level hazards associated with operating machinery and suitable precautions required.
- 3) Mechanical hazards and precautions required.
- 4) Electrical shock hazards, prevention, and emergency action required.
- 5) High pressure pneumatic/hydraulic systems hazards, power take-off hazards, and precautions to be observed.
- 6) Hazards associated with battery changing and precautions to be observed.
- 7) Hazards of manual lifting; precautions to be observed.

c. Test personnel shall be instructed in the operation and known limitations of the test item. Training shall include, but not be limited to, the following:

- 1) Fundamental operating instructions for agricultural-type tractors.
- 2) Test item physical description.
- 3) Design goals for performance.
- 4) Limitations.
- 5) Mechanical operations.
- 6) Functions of tractor controls and preventive maintenance checks.
- 7) Tractor demonstration and driving instructions.
- 8) Pre-operational checklist usage.

6.2 TEST CONDUCT

NOTE: All equipment malfunctions shall be reported in accordance with USATECOM Regulation 70-23.

6.2.1 Subsystem Tests

These procedures provide for the testing of agricultural tractor components/assemblies/subassemblies which, to be tested, do not require removal from the test item or test item disassembly.

6.2.1.1 Clutch Pedal Test

To determine the force required to depress the test item clutch pedal, proceed as follows:

a. Obtain a scale indicating device (pressure-type) or the equivalent, which is suitable for attaching to the test item clutch pedal.

b. Thermally stabilize the test item at standard ambient temperature. Record the temperature.

c. With the tractor engine not running, depress the clutch pedal several times to ensure proper lubrication.

d. Attach the indicating device to the clutch pedal.

e. Apply pressure slowly and evenly until the clutch pedal is depressed to within one inch of the floor plate. Record the maximum gauge reading.

f. Place the gear shift in the neutral position. Set hand brake.

g. Start the engine; allow for a fifteen minute warm-up period. (Follow starting engine instructions for starting, if applicable).

h. Repeat procedural steps d and e. In addition to the maximum gauge reading, record any indication of altered clutch pedal operating characteristics.

6.2.1.2 Steering Test

Determine test item steering characteristics in accordance with MTP 2-2-609 and the following:

a. Place the tractor on a dry, level, brushed concrete surface with the steer wheels set in a straight ahead position.

b. Thermally stabilize the test item at standard ambient temperature. Record the temperature value.

c. Attach an adapter pulley having a root diameter equal to the steering wheel diameter, to the spokes of the hand steering wheel.

d. Apply a steady force to a dynamometer attached to the adapter pully in a counter-clockwise direction and in the wheel plane, until the wheel turns.

e. Record the maximum gauge reading at extreme ends of the steer range.

f. Perform procedural steps d and e in a clockwise direction. In addition to the gauge reading, record any indication of altered steering wheel operating characteristics.

g. Raise the tractor front end until the front wheels clear the surface. Block the test item in this position.

h. Lock one front steerable wheel in a straight ahead position.

i. Apply, through a tension dynamometer in a clockwise direction, the specified force. (Conventional manual or power-assisted steering).

NOTE: When all hydraulic steering is used, the relief valve should be made inoperative. Also, the specified force should be applied with tractor power off.

j. Apply procedural step i four times and record whether or not steering mechanism and hydraulic linkages were able to withstand the applied force without evidence of failure or permanent deformation.

k. Repeat procedural steps i and j for the counter-clockwise direction.

l. Remove test apparatus, unblock and lower the tractor to the level, brushed concrete surface.

m. Turn the steering wheel such that the steer wheels are at an extreme left position.

n. Measure and record the number of turns of the hand steering wheel required to turn the steer wheels from the extreme left position to the extreme right position.

o. Repeat procedural steps m and n, beginning with the steer wheels set to extreme right.

6.2.1.3 Brake Tests

Determine the performance characteristics of test item service and parking brakes in accordance with MTP 2-2-608 and the following:

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a. Place the test item on a dry, level, brushed concrete surface.

NOTE: If the surface friction between the concrete and tractor tires is less than 0.50, the surface may be brushed with abrasion compound or other material to provide a 0.90 coefficient of friction.

b. Thermally stabilize the test item at standard ambient temperature. Record the temperature value.

c. Attach a suitable pressure gauge to the test item brake pedal in a manner which will enable pressure to be applied to the face of the gauge.

d. Attach a tension dynamometer to the tractor pintle hook.

e. Attach one end of a block and tackle, or similar mechanical device to the tension dynamometer, and the other end to an anchoring device.

f. Pull the tractor with a suitable vehicle over the specified surface with the engine disengaged and parking brake released.

g. Apply sufficient brake pedal pressure to produce a force recorded on the dynamometer equal to specified percent of ultimate drawbar pull. Record this attained value.

h. Gradually reduce the brake pedal pressure until the tractor wheels just begin to turn while maintaining tension on the dynamometer. Record brake pedal pressure and dynamometer readings.

i. Repeat procedural steps d through h with the dynamometer attached to the front of the test item.

j. Fully engage test item parking brake and repeat procedural steps f and g. Record whether or not the parking brake meets the prescribed performance.

6.2.1.4 Electrical System Tests

Perform the applicable procedures of MTP 2-2-601.

6.2.1.5 Cooling System Tests

Perform the applicable procedures of MTP 2-2-607.

6.2.1.6 Accessory Tests

6.2.1.6.1 Lifting Attachment Test -

To determine whether or not test item lifting eyes comply with the specified requirements, perform the applicable sections of MIL-STD-209 and the following:

a. Weigh test item on suitable platform scales. Record this weight value.

b. Weigh tractor with rear wheels only on the scale. Record this weight value.

c. Measure the horizontal perpendicular distance from the center of the rear lifting eye to the vertical plane passing through the center of the front lifting eye. Record this distance value.

NOTE: Use front and rear lifting eyes on same side of tractor.

d. Measure the horizontal perpendicular distance from center of the front lifting eye to the vertical plane passing through the axis of the front wheels. Record this distance as a positive value when lifting eyes are forward, and as negative when the lifting eyes are rearward, of the forward wheels.

e. Secure the tractor to the floor/surface.

f. Apply a vertical force equal to four times the computed normal vertical force on a rear eye or the force equal to the weight of tractor, whichever is greater. The force should be applied through a tension dynamometer with the cable attached to the lifting eye such that the force applied is in a true vertical direction.

g. Repeat procedural step f for front lifting eyes. Use four times the computed normal vertical force on a front eye or the force equal to the weight of the tractor, whichever is greater.

h. Examine the lifting eyes at points where they are attached to the test item. Record visual evidence of permanent deformation, fractures or other signs of failure.

6.2.1.6.2 Kit Evaluation -

Evaluate kits in accordance with MTP 2-2-707.

6.2.1.6.3 Personnel Heating and Ventilation System Evaluation -

Perform the applicable procedures of MTP 2-2-708.

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6.2.1.7 Power-Train Test

Perform applicable procedures of MTP 2-2-605.

6.2.1.8 Power Take-Off Tests

Subject test item attachment power take-off drive(s) to SAE Standards test procedures J719C and J718C. Record data as required.

NOTE: See Appendix C for power take-off definition and terminology.

6.2.2 Overall Tractor Performance Tests

These procedures provide for the testing of agricultural tractors as a unit or system. Proceed with the following tests:

6.2.2.1 Drawbar Pull Test

To determine whether the tractor being evaluated meets the ultimate drawbar pull requirement, perform applicable procedures of MTP 2-2-604 and the following:

a. Place the test item on a dry, level, brushed concrete surface.

NOTE: If the surface friction between the concrete and tractor tires is less than 0.50, the surface may be brushed with abrasion compound or other material to provide a 0.90 coefficient of friction.

b. Thermally stabilize the test item at standard ambient temperature. Record the temperature value.

c. Measure and record barometric pressure at time of test. Record barometric pressure and test site altitude.

d. Attach the tractor pintle hook to an anchor of sufficient strength to withstand a force equal to ten times the test item rated drawbar pull value. This connection is made with sections of steel cable or chain in series with a dynamometer.

NOTE: The cable or chain anchor connection point should be at the same height as the test item pintle hook connection.

e. Inflate test item tires, with air only, to the specified or recommended pressure.

f. Start and warm up the tractor engine for fifteen minutes.

g. Start tractor forward in low gear and slowly accelerate until the dynamometer gauge reads maximum. Record the maximum drawbar pull value attained.

h. Repeat step g five times, with each operation separated by at least one hour.

i. If the test item did not attain the minimum specified drawbar pull value, record observations of test team members as to why the test item failed.

6.2.2.2 Wheel Slippage Test

a. Accurately measure on a smooth level surface a distance of 500 feet and mark appropriately.

b. With the tractor not loaded, drive the 500-foot distance measured in a. Count the revolutions of the drive wheels. Record the count, r.

c. With the tractor under rated load, drive the 500-foot distance measured in a. Count the revolutions of the drive wheels. Record the count, R.

d. Compute the percentage of wheel slippage:

$$\text{Percent slippage} = \frac{100 (R-r)}{R}, \text{ where}$$

R = Total drive wheel revolution count to traverse 500 feet under load.

r = Total drive wheel revolution count to traverse 500 feet under no load.

6.2.2.3 Acceleration-Acceleration Response Test

To determine the acceleration characteristics of the test item, perform applicable procedures of MTP 2-2-602 and the following:

a. Place the test item on a dry, level, brushed concrete surface.

b. Mark on the test surface an interval, "A-B", of specified length.

c. Warm up the tractor engine for fifteen minutes prior to testing.

d. Locate the unloaded tractor with its front wheels at point "A".

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e. Locate at point "A" and at point "B" photoelectric switches which are connected to a recently calibrated electronic timing device.

f. With the tractor engine running at idle speed, the transmission engaged, and the operator alerted, accelerate the test item at the maximum attainable speed from point "A to Point "B". Record the elapsed time.

g. Repeat step f five times.

h. Load the test item pintle with the rated trailing load. Repeat procedural steps f and g.

i. Place the test item with specified rated trailing load on level surfaces and with the engine running at idle speed and the transmission in low speed, forward drive. The clutch shall be disengaged.

j. Arrange a timing device to be started simultaneously with the engagement of the clutch.

k. At a prearranged signal, the test item operator shall depress the accelerator/engage the clutch (and start the timing device).

l. The tractor shall be observed closely. At the instant of tractor movement, the timing device shall be stopped and the elapsed time shall be recorded.

m. Repeat procedural steps k and l five times.

n. Repeat procedural steps k, l, and m for no-load conditions.

6.2.2.4 Speed Test

To determine test item attainable speed on a level surface over a measured distance, perform applicable procedures of MTP 2-2-602 and the following:

a. Place the test item on a dry, level, brushed concrete surface.

b. Mark on the test surface three points, "A", "B", and "C". The interval of "A-B" shall be equal to the distance required for the test item to achieve maximum velocity; the interval "B-C" shall be equal to eighty-eight feet. An automatic photoelectric timing device is connected to switches located at points "B" and "C".

NOTE: The eighty-eight foot length is used to simplify calculations since eight-eight feet per minute is equal to one mile per hour.

c. Thermally stabilize the test item at standard ambient temperature. Record the temperature value.

d. Warm up the tractor engine for fifteen minutes prior to testing.

e. Start the tractor run from point "A". Ensure that test item is operating in selected gear at maximum attainable speed by the time point "B" is passed. The test item is not loaded; the test is run five times.

f. Record the elapsed time for test item to travel from point "B" to point "C".

g. Perform procedural steps e and f for each forward gear range.

h. Attach the rated trailing load to the test item and perform procedural steps e and f for each forward gear range.

6.2.2.5 Fuel Consumption Test

Perform applicable procedures of MTP 2-2-603.

6.2.2.6 Turning Radius Test

To determine the minimum turning radius of the test item, perform applicable procedures of MTP 2-2-609 and the following:

a. Place the test item on a level, dry, brushed concrete surface.

b. Thermally stabilize the test item at standard ambient temperature. Record the temperature value.

c. Drive the tractor in full 360 degree turns to the right and to the left. Complete five turns in each direction. Measure the turning radius.

d. Record the turning radius for each trial to the right and left.

6.2.2.7 Gradeability and Side Slope Performance Test

Perform applicable procedures of MTP 2-2-610 and the following slope performance test.

a. Run the tractor engine for 5 minutes at the recommended low idle with the crankcase oil level at the low mark on the oil level indicator and with the right side of the tractor downhill on a 30 percent slope or

simulated slope. Record actual value.

b. Repeat a with the left side of the tractor downhill.
Record actual value.

c. Repeat a with the front of the tractor downhill on a 30 percent slope or simulated slope. Record actual values.

d. Repeat a with the rear of the tractor downhill on a 30 percent slope.

e. Run the tractor engine for 15 minutes at top governed speed with the crankcase filled to the full level and with the right side of the tractor downhill on a 30 percent slope or simulated slope.

f. Repeat with the left side of the tractor downhill. Record actual values.

g. Repeat e with the front of the tractor downhill on a 30 percent slope or simulated slope.

h. Repeat e with the rear of the tractor downhill on a 30 percent slope or simulated slope.

i. Record evidence of tractor engine damage, overheating, and/or loss of performance during conduct of a through h.

6.2.2.8 Fording and Immersion Test

Perform applicable procedures of MTP 2-2-612.

6.2.2.9 Mobility Test

Perform applicable procedures of MTP 2-2-619.

6.2.2.10 Towing Tests

a. Use the test item to tow a drag-type load which requires 90 percent of the rated drawbar pull. Operate the tractor at maximum obtainable speed in low gear. Record actual value.

b. Tow the load of a for a distance of 250 feet and stop the tractor for a ten second period.

c. Repeat the cycle every 250 feet for five continuous hours (stop only for refueling). Record actual values.

d. Record evidence of the following:

1) Clutch slippage or overheating.

2) Breakage or malfunctioning of any part or component.

e. Repeat step a for tractor maximum tractor speed. Reduce dragtype load to 35 percent of rated drawbar pull. Record actual values.

f. Repeat step b except tow the 35 percent maximum load for a distance of 500 feet, stopping for a ten-second period. Record actual value.

g. Repeat step c.

h. Record evidence of the following:

- 1) Clutch slippage or overheating.
- 2) Breakage or malfunctioning of any part or component.

6.2.2.11 Durability

To determine the durability characteristics of the test item under controlled conditions while undergoing a 720 mile test circuit, perform the applicable procedures of MTP 2-2-506, MTP 2-2-611, and the following:

a. The test course shall be set up equivalent to the provisions of Appendix A, Outdoor Course for Tractors.

b. The test course obstacles shall be constructed in accordance with Appendix B, Obstacle Block Construction and MTP 2-2-611.

c. The test course shall be paved with concrete, asphalt, macadam, or equivalent, having a road resistance of 30 to 50 pounds per ton.

d. During conduct of the endurance test, the course should be dry, clean, and free of snow, ice, nonplanned obstacles, or other foreign materials.

e. Testing shall be accomplished during daylight hours.

f. The test item shall complete 1440 complete circuits of the test course, with 12 circuits being equivalent to one hour of operation. The test vehicle shall traverse the endurance course at the maximum safe practical speed.

g. The following shall be accomplished during test item traverse of the endurance course:

- 1) Lights of the test item shall be illuminated at all times, except at the beginning of each lap when the light switch shall be turned "off" and "on" again.
- 2) Maintenance and inspections shall be performed in accordance with the draft technical manual or after completion of each 480 test course circuits.

- 3) A trailing test load shall be connected to the test item for the complete 1440 circuits except for maintenance and when negotiating the obstacle blocks.
- 4) At the beginning of each lap, the operator shall sound the horn for one second.
- 5) The test item ignition switch shall be turned off and on after each 12 circuits.
- 6) On alternate days, the endurance test course shall be traversed in the opposite direction.

h. At the completion of the required number of circuits, the test item should be given routine inspection and service in accordance with the draft technical manual. A record of this inspection shall be kept; an example of a post-test inspection record form is provided by Figure 1.

NOTE: For each item listed vertically by Figure 1, five possible inspection/action outcomes are listed horizontally: (1) Item OK, (2) Item Not OK, (3) Adjust, (4) Repair, and (5) Replace. Therefore, if outcome (2) is indicated, there should be a corresponding check of (3) or (4), or (5), as appropriate.

6.2.2.12 Broadband Radio Interference Test

Subject the test item to appropriate procedures of MTP 2-2-613 and applicable requirements of MIL-STD-461, MIL-STD-462, and MIL-S-10379.

6.2.3 Environmental Effects Tests

6.2.3.1 Climatic Extremes Tests

Performance testing of the test item under desert, arctic, and tropic conditions should be performed in accordance with MTP 2-4-001, MTP 2-4-002, and MTP 2-4-003.

6.2.3.2 Intermediate Climatic Tests

Subject the test item to climatic conditions representative of the Intermediate Climate as defined by AR 70-38. Use the following procedure and applicable tests contained in MIL-STD-810B.

6.2.3.2.1 Rain Test -

To determine whether or not the test item will perform properly when subjected to rain, perform the following test on the rain test course.

DESCRIPTION	(1) OK	(2) NOT OK	(3) ADJUST	(4) REPAIR	(5) REPLACE
Automatic Coupler					
Brakes					
Clutch					
Cooling-Thermostat					
Differential					
Drive Axle					
Drive Shaft and Universal					
Electric Components					
Instruments					
Wiring					
Battery					
Lights					
Engine					
Frame and Body					
Fuel System					
Instrumentation					
Muffler					
Power Take-off(s)					
Springs					
Steering					
Transmission					
Torque Converter					
Wheels					

Figure 1. Post-Test Inspection Form

Instructions for use: Following 6.2.2.11, Durability Test, examine each item listed above in sufficient detail to determine any defects or excessive wear which have caused malfunctions in the test item or could cause malfunctions during normal operation. Place a check mark in column No. 1 or No. 2. If column No. 2 is checked, also check column Nos. 3, 4, or 5.

a. Park the tractor on a horizontal surface and expose to natural or simulated rain falling toward the tractor at an angle of approximately 45 degrees to the horizontal. The volume of rain impinging on the horizontal surface shall be not less than 1/4 gallon per minute per square foot of wetted, horizontal area. Simulated rain shall originate from a source which produces droplets of uniform distribution and velocity similar to natural rain at the point of contact with the tractor. Conduct the test as follows:

- 1) Expose the top and left side to the rain as described above for a period of 5 minutes with the engine shut down.
- 2) With water flowing, start engine within 2 minutes (without removing accumulated water) and allow engine to idle for 2 minutes.
- 3) Repeat (1) and (2) with the top and front exposed.
- 4) Repeat (1) and (2) with the top and right side exposed.
- 5) Repeat (1) and (2) with the top and back side exposed.

b. At the conclusion of the test, examine the tractor for the following:

- 1) Water in the air-intake filter.
- 2) Water leakage into the torque-converted oil chambers, engine crankcase sump, transmission, fuel tank, and hydraulic reservoir (when provided).
- 3) Performance of the electrical components, gauges, and instruments.

NOTE: Water in the air-intake filter in excess of 8 percent of the fluid capacity of the sediment chamber will constitute a malfunction.

c. Record:

- 1) Rain test conditions and test parameter.
- 2) Results of subtests.
- 3) Findings of inspection following tests.

6.2.3.2.2 Low Temperature Test -

Subject the tractor to the following procedure:

a. Service the test item with lubricants and other fluids in accordance with the draft technical manual for temperatures not to exceed the lower limit of the intermediate climate (AR 70-38).

b. Park the tractor on a horizontal surface and expose to natural or simulated low temperatures. Record the stabilized value.

c. Start the engine by cranking with the batteries which are on the tractor and have been stabilized at the low temperature. Consult MTP 2-2-650. Record the results of this test including length of time required for engine starting.

NOTE: Do not use substitute batteries or other external cranking energy.

d. Fifteen minutes after starting, operate the engine under rated-load conditions, i.e., repeat the Drawbar Pull Test, 6.2.2.1 and the Acceleration-Acceleration Response Test, 6.2.2.3. Record results as required by those procedures.

NOTE: Ensure that the operator is properly clothed for this test. Note operator inability to operate any control or perform any test item task because of cold-weather clothing.

6.2.3.2.3 High Temperature Test -

Subject the tractor to the following procedures:

a. Service the test item with lubricants and other fluids in accordance with the draft technical manual for temperatures not to exceed the upper limit of the intermediate climate (AR 70-38).

b. Park the tractor on a horizontal surface and expose to natural or simulated high temperatures. Record the stabilized value.

c. Start the tractor engine. Record the length of time required; the note of item d. above applies.

d. Fifteen minutes after starting, operate the engine under rated-load conditions, i.e., repeat the Drawbar Pull Test, 6.2.2.1 and the Acceleration-Acceleration Response Test, 6.2.2.3. Record results as required by those procedures.

6.2.4 Transportability

6.2.4.1 Preparation for Test

a. Preserve, pack, and otherwise prepare the test item for transport in accordance with MIL-T-3351, of applicable issue.

b. Perform the applicable sections of MTP 10-2-503 and the following:

6.2.4.2 Rail Transport Test

a. Load the test item onto a railway flatcar and secure with lashings, bracing, blocking, and cushioning material in accordance with provisions of MIL-STD-1186.

b. Attach recording accelerometer sensors to the railcar along the longitudinal, transverse, and vertical axes. Record the following:

- 1) Equipment used for loading.
- 2) Difficulties encountered during loading operations.
- 3) Materials description used for securing, etc.
- 4) Location of accelerometer sensors.

c. Operate the railroad car over a fifty mile (minimum length) course at normal operating speeds. Perform five abrupt starts and five abrupt stops from varying speeds. Record the following:

- 1) Speed prior to abrupt stop.
- 2) Accelerometer shock-vibration recording charts.
- 3) Damage incurred by the test item, including packing material.

d. The test item shall be subjected to the abrupt shock of railway "in-motion" couplings (humped couplings). The test item shall be loaded and secured to a flatcar (see a above) of 169,000 pounds (minimum). With the test item flatcar brakes set to "ON", couplings shall be accomplished at various speeds, including 4, 6, and 8 m.p.h. Record the following:

- 1) Speed at which the "humped couplings" were made.
- 2) Flatcar weight, etc.
- 3) Accelerometer sensor recordings.
- 4) Buffer-device movements.
- 5) Damage to test item or packaging material.

e. During conduct of the rail transport test, the test item shall be checked for evidence of overhang against AAR, Berne International, and Composite (Broad Gage) clearance devices. Record the following:

- 1) Overhang/restrictions encountered. Include all available information.
- 2) Test item disassembly required for clearance.
- 3) Time to disassemble, etc., if applicable.

f. Unload the test item from the railcar and record the following:

- 1) Materials handling equipment (MHE) used during unloading.
- 2) Difficulties encountered during unloading.

g. Disassemble the test item and inspect components for damage. Record the findings of this inspection.

6.2.4.3 Vehicle Transport Test

a. Load the test item aboard appropriate highway-type transport vehicle. Use MHE as required. Record the following:

- 1) Type of transport vehicle.
- 2) MHE used during loading.
- 3) Method and materials used for securing test item.
- 4) Difficulties encountered during loading operation.

b. Attach accelerometer sensors to the carrier to obtain shock readings which occur during transport along the longitudinal, transverse, and vertical axes. Record the locations of these sensors.

c. Drive the loaded carrier at various safe speeds not to exceed 45 miles per hour. The road types listed below shall be traversed for a minimum distance of five miles each.

- 1) Improved gravel road.
- 2) Cobblestone road.
- 3) Loose-rock road.
- 4) Paved highway.
- 5) Washboard road. (Two-inch washboard, minimum).

d. Emergency stopping: With the test item loaded on the carrier, and with the hand brakes set to the "ON" position, determine the adequacy of test item securing methods and test item ability to withstand shock forces which could occur during normal vehicular transport. Proceed as follows:

- 1) Instrument the transported bed with recording accelerometer sensors along the transverse, longitudinal, and vertical axes.
- 2) Conduct emergency stopping tests three times minimum on a dry, level, straight, and paved surface which is free of foreign objects from a speed of ten m.p.h. Determine and record following each emergency stop:
 - a) Adequacy of securing devices and methods.
 - b) Adjustments required to securing devices.
 - c) Braking distance(s).
 - d) Recording accelerometer reading/charts.
 - e) Damages sustained by test item or vehicular carrier.
- 3) Photograph the emergency stopping portion of the test with still and motion picture cameras. In particular, photograph stopping performance, shifting of test item, and incurred damage(s).

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- 4) Repeat step a through c for speeds of 20, 30, and 45 m.p.h.

e. Following conduct of the vehicular transport test, the test item should be disassembled and inspected for component damage. Record the findings of this inspection.

6.2.4.4 Marine Transport Test

a. Load the test item aboard a transport-type ship of the appropriate class, or a ship simulation facility capable of duplicating shipboard loading conditions and ship's motion (pitch and roll). Use normal MHE. Record the following:

- 1) Ship type (actual or simulated).
- 2) MHE utilized during loading.
- 3) Materials and methods used for securing test item.
- 4) Difficulties encountered during loading.

b. Conduct rough water transit(s) (if possible) under sea state 5, 10-18 foot waves, and wind speeds of 28-31 knots. Record the following:

- 1) Sea State.
- 2) Wind speed and direction.
- 3) Recording accelerometer readings/charts.
- 4) Damage to test item or bracing.

c. Where actual transport vessels are not available, subject the packaged test items to ship motion simulation of $\pm 30^\circ$ roll, 30-second period and pitch angles of $\pm 5^\circ$ with a 20-second period. Conduct the test for one hour, minimum. Record the following:

- 1) Actual pitch/roll values.
- 2) Accelerometer recording readings.
- 3) Damage to test item or packaging material.

6.2.4.5 Air Transport Suitability Tests

The test item should be packaged by TOE personnel and subjected to the evaluation of MTP's 7-2-509 and 7-2-510.

6.2.4.6 Logistics Over the Shore (LOTS)

Subject the test item to applicable procedures of MTP 2-2-520.

6.2.5 Maintenance Evaluation

Evaluate the maintenance related factors of the test item as described in MTP 10-2-507 with emphasis on the following:

a. Organizational (O), Direct Support (F), and General Support (H) Maintenance requirements.

b. Operator through General Support Maintenance Literature, if applicable.

c. Repair parts.

d. Calibration standards and facilities.

e. Test and handling equipment.

f. Maintenance facilities.

g. Personnel skill requirements.

h. Maintainability.

i. Availability.

6.2.6 Reliability

Evaluate and appraise the reliability related factors of the test item.

6.2.7 Safety

Provide a safety release statement in accordance with USATECOM Regulation 385-6 and observe all normal precautions governing the operation of the test item and test equipment. Vehicle safety characteristics shall be evaluated in accordance with MTP 2-2-508.

a. During conduct of all engineering tests, observe the safety characteristics of the test item and record, as a minimum, the following:

- 1) Any dangerous or unsafe condition or any condition that might present a safety hazard including the cause of the hazard. Record the steps taken to alleviate any such hazard.
- 2) The safety features incorporated into test item design.
- 3) Adequacy of warning instructions and markings.
- 4) Suggestions to improve the existing safety precautions.

b. Throughout the engineering tests observe standard vehicular safety precautions. See Appendix D for a list of important precautions to be observed.

6.2.8 Human Factors Evaluation

The test item shall be evaluated to determine the degree to which its physical design and revealed performance characteristics conform to recognized human factors engineering design criteria. In order to facilitate this evaluation, prepare checklists of design criteria applicable to Class I-A material as defined by Human Factors Evaluation Data for General Equipment (HEDGE). In particular, checklists will be prepared for all tasks which rate the task from a human factors standpoint as either satisfactory or not satisfactory. Also, incorporate applicable procedures of MTP 2-2-803 and the following:

a. General considerations to be included in checklists for
all tests:

- 1) Adequacy of furnished instructions
- 2) Ease of performing tasks.
- 3) Human factors design deficiency revealed by particular test.
- 4) Time to perform test.
- 5) Personnel required for task.

b. Area considerations to be included in checklists for
all tests:

- 1) Controls and indicators.
 - a) Location: How easy to operate and read.
 - b) Markings: Clearly marked for function.
- 2) Ease of controlling and adjusting test item when installed and operating.

c. Include in the technical performance checklist revealed performance characteristics which do not conform to recognized human factors design criteria.

d. Considerations to be included in checklist for the
maintenance evaluation:

- 1) Ease of locating malfunctions and determination of cause.
- 2) Access to defective component.
- 3) Ease of replacement and/or repair of malfunction.

e. Operability.

f. Transportability.

g. Noise Level.

h. Record any inadequacies of test item design affecting ease of vehicle operation.

1. Record any recommendations to improve man-item effectiveness.

6.2.9 Value Analysis

During the conduct of all tests, test personnel shall rate the test item from a value standpoint and shall record comments concerning any features of the test item which can be eliminated and/or cost reduced without degrading the test item in performance and safety. The applicable portions of USATECOM Regulation 700-1 shall be used as a basis for this evaluation. Accomplish the following:

- a. During operation of the test item, observe for features which could be eliminated without compromising performance, reliability, durability, or safety.
- b. Question test personnel regarding features of the test item which could be eliminated without decreasing the functional value of the test item or decrease man-item effectiveness.
- c. Record the following for each feature or component of the test item being examined:
 - 1) Description of feature.
 - 2) Recommended change to be made.
 - 3) Reason(s) for recommendations.

6.2.10 Quality Assurance

Throughout all tests, examine the test item for compliance with the quality requirements of the applicable MN and the provisions of MTP 10-2-511.

6.3 TEST DATA

6.3.1 Initial Inspection

Record the following:

- a. Data required by applicable procedures of MTP 2-2-502.
- b. Evidence of damage or deterioration of test item or materials used for protection during shipment.
- c. Identification markings which were not in accordance with MIL-STD-129, MIL-STD-130, or test item detail specification.
- d. Evidence of defects in:
 - 1) Manufacturing.
 - 2) Material.
 - 3) Workmanship.

6.3.2 Inventory Check

Record the following:

- a. Missing maintenance literature or draft technical manual(s).
- b. Shortages in repair parts, accessories, or tools.
- c. Missing kits.

6.3.3 Inspection and Preliminary Operation

Record the following:

- a. Data required by procedures of MTP 2-2-502.
- b. Data required by applicable procedures of MTP 2-2-505.

6.3.4 Laboratory and Bench Tests

Record the following:

- a. Data required by applicable procedures of MTP 2-2-700.
- b. Data required by applicable procedures of MTP 2-2-703.
- c. Data required by applicable procedures of MTP 2-2-704.
- d. Data required by applicable procedures of MTP 2-2-614.
- e. Data required by applicable procedures of MTP 2-2-800.

6.3.5 Physical Characteristics

Record the following:

- a. Data required by applicable procedures of MTP 2-2-500.
- b. Engine:
 - 1) Type, i.e., gasoline or diesel.
 - 2) Characteristics, i.e., bore, stroke, displacement, compression ratio, r.p.m. at maximum torque, etc.
 - 3) Fly wheel horsepower.
- c. Width, less attachments, accessories, or accessory mount(s).
- d. Test item length, less coupler(s).
- e. Height, less cab.

- f. Turning radius, minimum.
- g. Wheelbase.
- h. Track width, maximum and minimum if adjustable.
- i. Governed speed.
- j. Drawbar pull.
- k. Center of gravity.
 - 1) Vertical.
 - 2) Horizontal.
- l. Gross vehicle weight.
- m. Counter weight information, e.g., removable, weight, etc.
- n. Safety equipment supplied.
- o. Tires.
 - 1) Front.
 - a) Size, i.e., 6:40-15, etc
 - b) Number of plies, i.e., 4, 6, 8, etc.
 - 2) Rear (record identical data as front tires).

6.3.6 Operator Training and Familiarization

Record the data required by MTP 10-2-501, paragraph 6.1.6 of this document, and other criteria as required.

6.3.7 Clutch Pedal Test

Record the following:

- a. Test site temperature at time of test, in degree F.
- b. Maximum force required to depress the clutch pedal, (engine running), in pounds.
- c. Maximum force required to depress the clutch pedal, (engine on), in pounds.
- d. Characteristics of clutch pedal operation which differed with engine running.

6.3.8 Steering Test

Record the following:

- a. Data required by applicable procedures of MTP 2-2-609.

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- b. Temperature at time of test, in degrees F.
- c. Maximum gauge reading at extreme end of clockwise steer range, in pounds.
- d. Maximum gauge reading at extreme end of counterclockwise steer range, in pounds.
- e. Following application of specified force to steering mechanism with steerable wheel (s) locked, list any damage or evidence of failure/permanent deformation.
- f. Number of turns of the hand steering wheel to move the steer wheels from one extreme position to the other.

6.3.9 Brake Tests

Record the following:

- a. Data required by applicable procedures of MTP 2-2-608.
- b. Test site temperature at time of test, in degrees F.
- c. Brake test force, in percent of ultimate drawbar pull.
- d. Tension on dynamometer (just as wheels begin to turn),
in pounds.
- e. Force applied to brake to produce tension recorded by d
above, in pounds.
- f. Data required by d and e above when dynamometer is attached
to opposite end of test item.
- g. Data required by d and e above when procedure is repeated
for fully engaged parking brake. Also, indicate whether or not parking brake
meets the prescribed performance.

6.3.10 Electrical System Tests

Record the data required by applicable procedures of MTP 2-2-601.

6.3.11 Cooling System Tests

Record the data required by applicable procedures of
MTP 2-2-607.

6.3.12 Lifting Attachment Test

Record the following:

- a. Test item weight (test item only), in pounds.
- b. The test item weight with only rear wheels on the scale,
in pounds.
- c. Horizontal perpendicular distance from the center of the
rear lifting eye to the vertical plane passing through the center of the front
lifting eye, in inches.
- d. Horizontal perpendicular distance from center of the
front lifting eye to the vertical plane passing through the axis of the front
wheels, in inches. (When this distance is forward of the lifting eye
record as positive, and negative when distance is to the rear of the eye).
- e. Following application of the test force, list any evidence
of damage to the lifting eye(s) and at the points where connection is made
to the test item.

6.3.13 Kit Evaluation

Record data as required by applicable procedures of MTP 2-2-707.

6.3.14 Personnel Heating and Ventilation System Evaluation

Record data as required by applicable procedures of MTP 2-2-708.

6.3.15 Winch Evaluation

Record data as required by applicable procedures of MTP 2-2-712.

6.3.16 Power-Train Test

Record data as required by applicable procedures of MTP 2-2-605.

6.3.17 Power Take-off Tests

Record the data resulting from the conduct of SAE tests: J718C
and J719C.

6.3.18 Drawbar Pull Tests

Record the following:

- a. Data required by applicable procedures of MTP 2-2-604.

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- b. Test site temperature at time of test, in degrees F.
- c. Barometric pressure, in inches of Hg.
- d. Test site altitude, in feet above sea level.
- e. Maximum drawbar pull value attained, in pounds.
- f. Test team comments regarding test item and reasons for not attaining required drawbar pull, when applicable.

6.3.19 Wheel Slippage Test

Record the following:

- a. Number of drive wheel revolutions (not loaded), r.
- b. Number of drive wheel revolutions (loaded, R.
- c. Percentage of wheel slippage, computed.

6.3.20 Acceleration-Acceleration Response Test

Record the following:

- a. Data required by applicable procedures of MTP 2-2-602.
- b. Test interval distance (A-B), in feet and inches.
- c. Time required for test item to traverse interval A-B,
in seconds.
- d. Time required for test item to traverse interval A-B,
pulling rated trailing load, in seconds.
- e. Test item acceleration response time, fully loaded, in
seconds.
- f. Test item acceleration response time, not loaded, in
seconds.

6.3.21 Speed Test

Record the following:

- a. Data required by applicable procedures of MTP 2-2-602.
- b. Test site temperature at time of test, in degrees F.

c. Elapsed time for test item to traverse an eighty-eight foot interval at maximum speed, in seconds, (forward direction, no load).

d. Elapsed time for test item to traverse an eighty-eight foot interval at maximum speed, in seconds, (rearward, not loaded).

6.3.22 Fuel Consumption Test

Record data as required by applicable procedures of MTP 2-2-603.

6.3.23 Turning Radius Test

Record data as follows:

a. Data required by applicable procedures of MTP 2-2-609.

b. Test site temperature at time of test, in degrees F.

c. Test item turning radius, in feet.

6.3.24 Gradeability and Side Slope Performance Test

Record data required by applicable procedures of MTP 2-2-610 and the following:

a. Low-idle time, in minutes.

b. Oil-level, i.e., low mark, etc.

c. Slope, i.e. down hill, etc., in degrees.

d. Evidence of engine overheating damage, etc.

e. Data of a through d for tractor left side on the downhill slope.

f. Data of a through d for front of tractor on downhill slope.

g. Data of a through d for rear of tractor on downhill slope.

h. Repeat data of a through g for tractor full governed speed.

6.3.25 Fording and Immersion Test

Record data required by applicable procedures of MTP 2-2-612.

6.3.26 Mobility Test

Record data required by applicable procedures of MTP 2-2-619.

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6.3.27 Towing Tests

Record the following:

- a. Type of drag load used.
- b. Weight of load, express as percent of maximum rated drawbar pull.
- c. Number of 250 foot run cycles accomplished.
- d. Average delay time between runs, in seconds.
- e. Evidence of the following:
 - 1) Clutch slippage or overheating.
 - 2) Breakage or malfunctioning of any part or components.
- f. Repeat data of a through e for tractor top speed runs.

6.3.28 Durability Test

Record the following:

- a. Data required by applicable procedures of MTP 2-2-506 and 2-2-611.
- b. Complete the data requirements of Figure 1 or equivalent.

6.3.29 Broadband Radio Interference Test

Record data as required by applicable procedures of MTP 2-2-613.

6.3.30 Climatic Extremes Tests

Record data resulting from tests and evaluations of MTPs 2-4-001, 2-4-002, and 2-4-003.

6.3.31 Intermediate Climatic Tests

Record data required for tests conducted under MIL-STD-810B and the following:

- a. Rain test:
 - 1) Type of rain course, i.e., natural, simulated.
 - 2) Rain rate, in gallons per minute.
 - 3) Exposure schedule and exposure times.

- 4) Evidence of the following:
 - a) Water in air-intake filter.
 - b) Water in sump, fuel tank, or hydraulic reservoir, etc.

b. Low temperature test:

- 1) Stabilized low temperature value, in degrees F.
- 2) Length of time required to start cold tractor.
- 3) Results of performance retests, i.e., 6.2.2.1 and 6.2.2.3, etc.

c. High temperature test:

- 1) Stabilized high temperature, in degrees F.
- 2) Length of time required to start tractor.
- 3) Evidence of overheating.
- 4) Results of performance retests, 6.2.2.1, 6.2.2.3, etc.

6.3.32

Transportability Tests

Record the following:

a. Rail test, loading:

- 1) Equipment used for loading.
- 2) Difficulties encountered during loading operations.
- 3) Materials description used for securing, etc.
- 4) Location of accelerometer sensors.

b. Rail test, operation:

- 1) Speed prior to abrupt stop.
- 2) Accelerometer shock-vibration recording charts.
- 3) Damage incurred by the test item, including packing material.

c. Rail test, humped:

- 1) Speed at which the "humped couplings" were made.
- 2) Flatcar weight, etc.
- 3) Accelerometer sensor recordings.
- 4) Buffer-device movements.
- 5) Damage to test item or packaging material.

d. Rail test, clearance:

- 1) Overhang/restrictions encountered. Include all available information.
- 2) Test item disassembly required for clearance.

- 3) Time to disassemble etc., if applicable.
- e. Rail test, unloading:
 - 1) Materials handling equipment (MHE) used during unloading.
 - 2) Difficulties encountered during unloading.
- f. Tractor damage discovered during inspection(s) following rail test(s).
- g. Vehicle transport, loading:
 - 1) Type of transport vehicle.
 - 2) MHE used during loading.
 - 3) Method and materials used for securing test item.
 - 4) Difficulties encountered during loading operation.
- h. Marine transport, rough transit:
 - 1) Sea state.
 - 2) Wind speed and direction.
 - 3) Recording accelerometer readings/charts.
 - 4) Damage to test item or bracing.
- i. Marine transport, rough transit simulation:
 - 1) Roll, in degrees.
 - 2) Roll period, in seconds.
 - 3) Pitch, in degrees.
 - 4) Pitch period in seconds.
- j. Data required by conduct of evaluations from MTPs 7-2-509 and 7-2-510, as applicable.
- k. Data required by conduct of evaluation from MTP 2-2-520.

6.3.33 Maintenance Evaluation

Record data required by applicable procedures of MTP 10-2-507 and Appendixes A and B to USATECOM Regulation 750-15.

6.3.34 Reliability

Record data required by applicable procedures.

6.3.35 Safety

Record the following:

- a. Data required by applicable procedures of MTP 2-2-508.

b. Any dangerous or unsafe condition or any condition that might present a safety hazard including the cause of the hazard.

c. Safety features incorporated into test item design.

d. Adequacy of warning instructions and markings.

e. Suggestions to improve the existing safety precautions.

6.3.36 Human Factors Evaluation

Record the following:

a. Data required by applicable procedures of MTP 2-2-803.

b. Checklists.

c. Noted inadequacies of test item design affecting ease of vehicle operation.

d. Recommendations to improve man item effectiveness.

6.3.37 Value Analysis

Record the following:

a. Nonfunctional, costly, or "nice-to-have" features of the test item.

b. Test personnel comments and opinions regarding features to be eliminated.

6.3.38 Quality Assurance

Record:

a. Data required by MTP 10-2-511.

b. Comments as to any design shortcomings in the area of required quality.

6.4 DATA REDUCTION AND PRESENTATION

Data obtained during conduct of the engineering tests shall be summarized, making use of curves, charts, photographs, or other graphic materials, as appropriate.

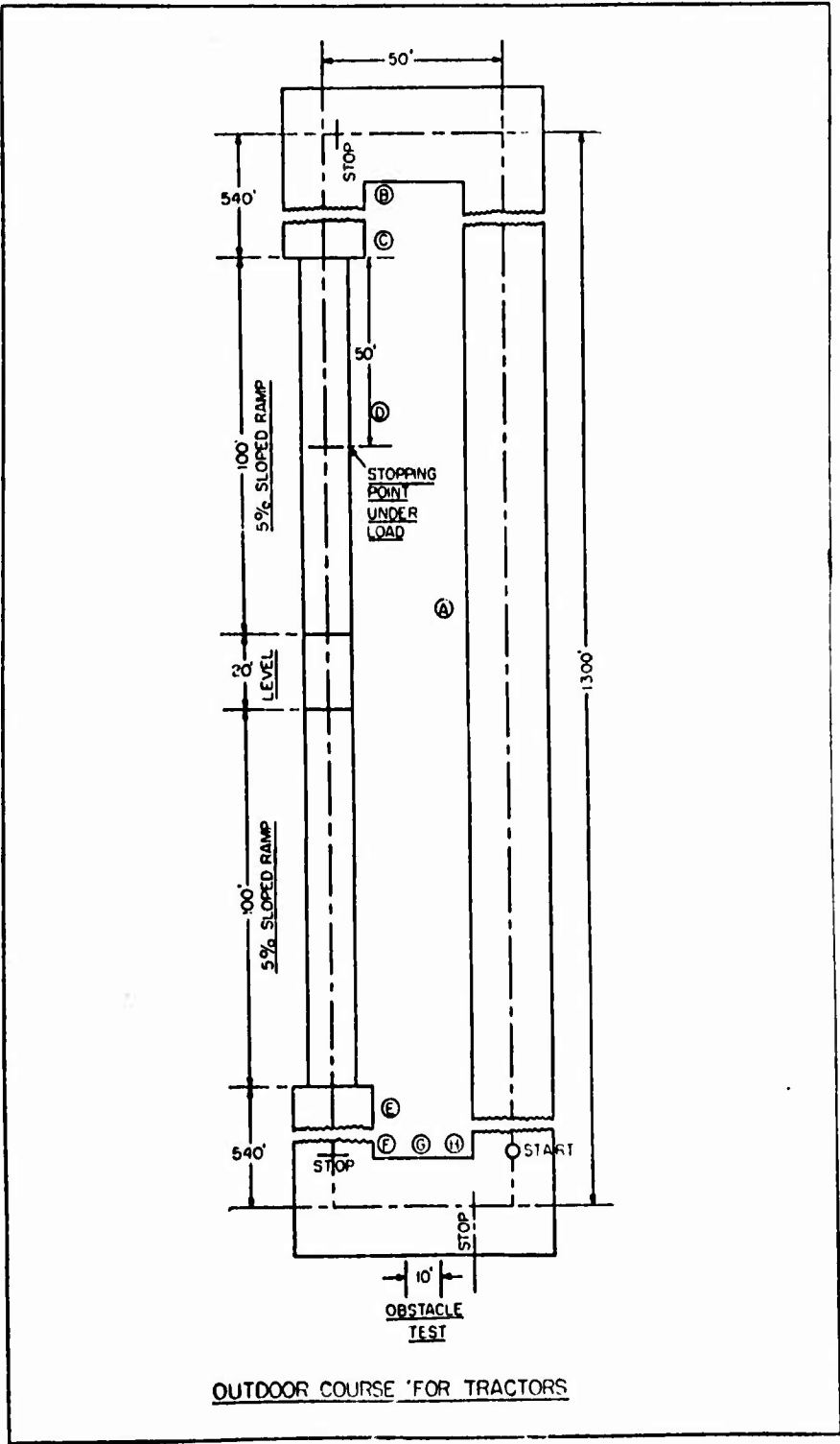
Data obtained for each test item performance characteristic shall be compared with technical performance characteristics specified in applicable MN, or other development criteria

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In addition, the data presentation shall include written, narrative reports on all test specified by this document.

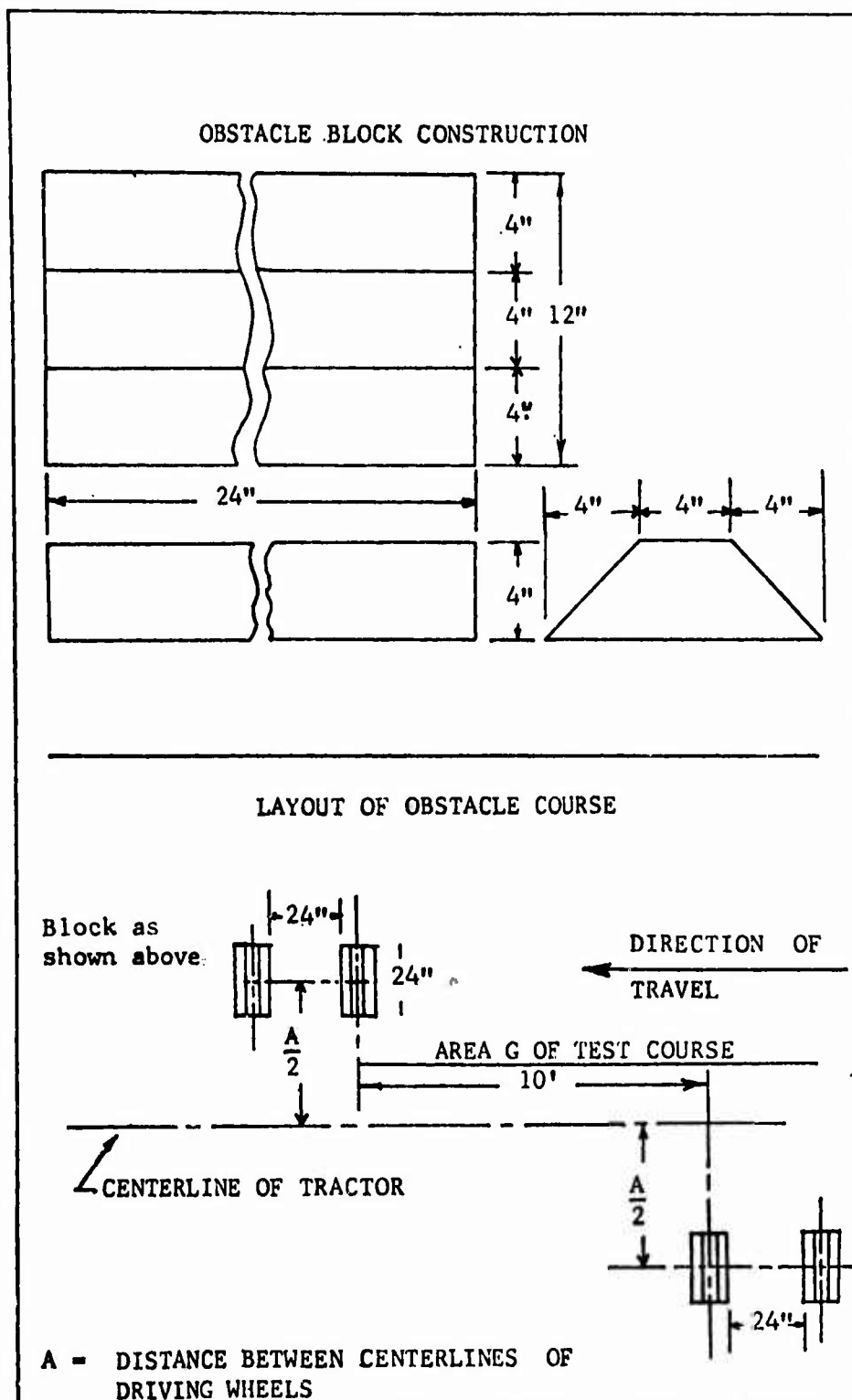
The report shall conclude with a summarization of the suitability of the test item for service testing.

APPENDIX A
ENDURANCE AND DURABILITY TEST COURSE DESIGN



APPENDIX B

OBSTACLE BLOCK CONSTRUCTION & LAYOUT



APPENDIX C

AGRICULTURAL TRACTOR POWER TAKE-OFF
DEFINITIONS AND TERMINOLOGY

GENERAL: This appendix deals with tractor power take-off(s) in which the power take-off rotational speed is proportional to the tractor engine speed. This is the type that prevails in the United States, Canada, England, and generally, throughout the world.

TERMINOLOGY:

Clutch, Master -- The term "master clutch" is generally used to describe a clutch which transmits all power from the engine and controls both travel and the power take-off. Likewise, when disengaged, both stop.

Power Take-off, Transmission Driven -- Power to operate both the transmission and the power take off is transmitted through a master clutch, which serves primarily as a traction clutch. The power take-off operates only when the master clutch is engaged. The transmission driven power take-off ceases to operate at any time the master clutch is disengaged.

Power Take-off, Continuous Running -- Power to operate both the transmission and the power take-off is transmitted through a master clutch. Both operate only when the master clutch is engaged. Auxiliary means are provided for stopping the travel of the tractor without stopping the power take-off. The continuous running power take-off ceases to operate at any time the master clutch is disengaged.

Power Take-off, Independent -- Power to operate the transmission and power take-off is transmitted through independent transmission and power take-off clutches. Travel of the tractor may be started or stopped by operation of the transmission clutch without affecting operation of the independent power take-off. Likewise, the power take-off may be started or stopped by the power take-off clutch without affecting tractor travel.

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APPENDIX D

SAFETY PRECAUTIONS

BEFORE OPERATION

Exercise care in handling fuel. Do not fill tractor fuel tank with engine running. Ground the fuel container to the frame to avoid igniting fuel vapors with a static spark.

Clean excess grease, oil, and spilled fuel from the tractor to avoid accidents by slipping or falling.

Do not clean, service, or make adjustments with the engine running unless absolutely necessary.

When inflating tires, stand clear of the lock-ring to avoid injury if it should be forced from the rim.

Be sure the tractor is properly blocked and brakes set when inspecting or servicing underneath.

Do not allow flame or smoking around flammable materials when servicing the tractor.

Use caution when filling batteries as electrolyte may cause serious burns if spilled on the body.

DURING OPERATION

Do not make sharp turns at high speeds.

Do not dismount from the tractor without first setting parking brakes.

Be sure there are no obstructions or personnel in the direction of travel before moving tractor.

Do not clean, service, or make adjustments with the engine running unless absolutely necessary.

Keep the transmission and clutch engaged while traveling down steep grades.

If the tractor engine is operated in an inclosed area, pipe the exhaust gases to the outside.

AFTER OPERATION

Before dismounting from the tractor, engage the brakes.

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Stop the engine before cleaning, servicing, or adjusting the tractor unless engine operation is absolutely necessary.

Clean all excess grease, oil, and spilled fuel from the tractor surfaces to prevent injury by slipping or falling.

Do not allow flame or smoking around flammable material while servicing the tractor.

Before making adjustments or servicing the underside of the tractor, provide adequate blocking and engage the brakes.

Use caution when removing the radiator cap to avoid burns from steam.